with Compliments from the
Author.

ON THE SIGNIFICATION AND ENDS OF THE PORTAL CIRCULATION.*

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In all the elementary works on physiology which I have lately consulted, I find the question of the source of the bile, —whether it be secreted from the blood of the portal vein, or from that of the hepatic artery?—discussed with more or less of earnestness; but I scarcely notice an inquiry into the cause of so singular a departure from the ordinary mode in which the blood is distributed, as that which we observe in the portal system; or, if any reason be assigned, it is merely by the way, and generally to the effect that the blood which had been circulating to the intestines and other organs engaged in the chylopoesis, was probably more impure, more loaded with the elements of bile, and therefore better fitted to afford these to the liver than ordinary arterial blood would have been.

But I believe, that the best physiologists are agreed in regarding the bile to be as much one of the products of the vital chemistry which is going on in every constituent atom of the body, as the carbon, which, in the shape of carbonic acid, is constantly eliminated by the lungs, and as the azote, which is no less incessantly thrown off in the form of urea by the kidneys. There can therefore be nothing in the nature of the blood of the portal system, which fits it more than any other for furnishing the principles of bile; there is no reason to suppose that these are produced in larger quantity in the coats of the intestines, than in the points of the fingers. That this is the fact is made certain by the occasional occurrence of cases in which the portal system was absent, yet in which the bile was secreted as usual.

The portal system, then, is not an arrangement indispensable to the preservation of the individual;—individuals have lived and have thriven without it, and there must consequently be another reason than any yet assigned, for its so general occurrence.

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When we look beyond the two higher classes in the animal kingdom, mammalia and birds, we find an important extension of the plan of circulation which among them we see limited to the liver: reptiles and fishes have actually a *portal system of the kidneys*, as well as a portal system of the liver. In fishes, the veins which return the blood from the tail and frequently from some of the internal abdominal organs, such as the ovaries, or testes and the swimming bladder, unite into a trunk or trunks which, instead of falling into the abdominal cava, proceed to the kidneys and there undergo distribution from stems to branches and capillaries, precisely as the vena portæ is distributed to the liver in quadrupeds and man. In reptiles there is also a renal as well as an hepatic portal system, the veins which are ramified through the kidneys in this class collcting their blood from the tail, hinder extremities, and abdomical parietes. It was even supposed by Jacobson of Copenhagen, who first called attention to the peculiar distribution of the veins to the kidneys which has just been indicated, that the same thing existed in birds; but this was an error; there is no portal system of the kidney in birds, although there is an evident approximation to it; for the vessels which return the blood from the tail, legs, &c., in these animals, form two large trunks which pass *over* the kidneys and receive contributions from them in their course to join the portal system.—And this, by the way is another argument in favour of the view that it is of no moment whence the blood is derived which feeds the liver: had the blood, which comes from the legs and tail of birds not been fitted to yield the elements of bile to the peculiar elective faculty of the liver, it would not have gone to be subjected to the action of that organ. What then is the reason of the portal system, whether of the liver or of the kidney, among animals? It appears to me in the light of *a simple contrivance for economising arterial blood.*

Of all the matters which are evolved in the course of the vital acts by which the body is maintained in its integrity, and by which its various wonderful attributes are manifested, no one appears to be so decidedly a poison as the carbon. It is on this account that the entire mass of the circulating fluid is sent, in all the higher animals, through a special apparatus, in which the free or superfluous carbon is literally burned out, before the blood is fitted for re-distribution to the system at large. Urea and bile, and the other products of the chemistry of the living body, are not so deleterious as carbon ; had they been so, the whole mass of circulating fluid must have been sent through the kidneys and the liver, just as it is through the lungs. Only a part of the blood requires to be subjected to the action of these organs in order to be maintained in sufficient purity for even the most important ends in the economy.

In the higher classes of animals, the kidneys are not of such magnitude, but that they can be fed with arterial blood without detriment to the rest of the body,—the quantity of blood that must be subjected to their action, in order that the amount of urea, salts, &c., mingled with the general circulating mass, may be kept within due bounds, is not more than can be easily afforded. But the supply of so large a viscus as the liver with arterial blood, for a purpose which, however important in itself, is still only secondary, would have been a serious matter, and would have implied an increase in the pulmonary system especially, to an extent that must have been felt as inconvenient. Had the liver been furnished with arterial blood as the means of affording bile, it must obviously have had a vessel sent to it of a calibre equal to the sum of the vessels whose contents are finally collected into the portal vein. Nature goes to work more economically ; she first uses the blood of the great abdominal arteries to vitalise the viscera, and then, gathering this into a common trunk, she sends it to minister to the function of the liver,—this blood as a vivifying fluid is exhausted for the time, but it will still yield the elements of bile if subjected to the elective affinity of the liver. The whole system of the liver is, in fact, calculated upon economic principles : the bile is necessary to the completion of the process of digestion, and, at the same time, it contains principles which, retained in the system, prove poisonous.

If we observe this husbandry of arterial blood in the higher animals, among which the respiratory system is so largely developed, we might, *a priori*, have expected an extension of the plan in inferior grades of creation, where the pulmonic system degenerates so notably. And, accordingly, we have seen that in reptiles, where the lungs become cellular sacs, and among fishes, where they are replaced by gills, not only is the bile, but the urine also, elaborated from venous blood. The small quantity of arterial blood sent to the liver, in all classes of animals, by the hepatic artery, and to the kidneys in reptiles and fishes, by the emulgents, is not to supply the pabulum of their special secretions, but to the end that they may be vivified and nourished like every other part of the organism to which they belong.

To ask whether secretion can take place from venous blood or not, has always seemed to me a somewhat puerile question. Had not secretion been destined to take place from the blood of the vena portarum, Nature would not have been at the pains to distribute it through the liver;—the existence of so peculiar an arrangement is already an answer to the question; the end of it is, as I have said, to economise arterial blood.

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